51. IWK

Internationales Wissenschaftliches Kolloquium

International Scientific Colloquium

PROCEEDINGS

11-15 September 2006

FACULTY OF ELECTRICAL ENGINEERING AND INFORMATION SCIENCE

INFORMATION TECHNOLOGY AND ELECTRICAL ENGINEERING - DEVICES AND SYSTEMS, MATERIALS AND TECHNOLOGIES FOR THE FUTURE

Startseite / Index:
http://www.db-thueringen.de/servlets/DocumentServlet?id=12391

TECHNISCHE UNIVERSITÄT
ILMENAU

Impressum

Herausgeber:	Der Rektor der Technischen Universität Ilmenau Univ.-Prof. Dr. rer. nat. habil. Peter Scharff
Redaktion:	Referat Marketing und Studentische Angelegenheiten Andrea Schneider Fakultät für Elektrotechnik und Informationstechnik Susanne Jakob Dipl.-Ing. Helge Drumm
Redaktionsschluss:	07. Juli 2006

Technische Realisierung (CD-Rom-Ausgabe):
Institut für Medientechnik an der TU Ilmenau
Dipl.-Ing. Christian Weigel
Dipl.-Ing. Marco Albrecht
Dipl.-Ing. Helge Drumm

Technische Realisierung (Online-Ausgabe):
Universitätsbibliothek Ilmenau
ilmedia
Postfach 10 05 65
98684 Ilmenau

Verlag:
isle
Verlag ISLE, Betriebsstätte des ISLE e.V.
Werner-von-Siemens-Str. 16
98693 Ilrnenau

ISBN (Druckausgabe): 3-938843-15-2
ISBN (CD-Rom-Ausgabe): 3-938843-16-0

Startseite / Index:
http://www.db-thueringen.de/servlets/DocumentServlet?id=12391

51st Internationales Wissenschaftliches Kolloquium
Technische Universität Ilmenau
September 11 – 15, 2006

E.Ulicna

A Study of reconfigurable SoC with Applications in Wireless Systems and SystemC

ABSTRACT

Wireless *SoC* (System-on-Chip) have seen very high levels of integration in the last few years. A *SoC* represents an increasing level of design complexity. On this account *SystemC* is emerging as a standard for digital system design and a standard language for continuous and mixed discrete-event/continuous time systems. A key design challenge is to support application-specific optimitization in a highly flexible manner. Typical design goals are compactness, low power consumption and to be flexible in order to meet a wide range of applications goals.

INTRODUCTION

The essential issue of *SoC* technology is the trade-off between cost and flexibility. Flexibility is typically achieved using software. By re-writing code the function can easily be changed without any hardware modification. Reconfigurable logic can achieve a much higher level of flexibility than hardware. *SoC* are more and more heterogeneous and include software, analog-RF and digital hardware. Heterogeneity typically occurs in the underlying *models of computation* (MoC) that are used to describe the hardware and software components of the system respectively. A *MoC* is a formal method of viewing and manipulating the circuit, a conceptual framework that allows a design to be specified, reasoned about, synthesized and tested. A general representation of digital systems and the levels of description, is the Y- chart [1] as drawn in Figure 1.

The design flow for reconfigurable technologies prefers that the specification is written in a high-level language like C++, which can be used to derive the final implementation in hardware or software [2], [3]. As an example of language-oriented design flows, *SystemC* as a standard language for digital system design can be used and also be applied to analog and mixed-signal (*AMS*) systems.

The goal of this study is to determine how to best support the design of the most important hardware modules using examples of hardware abstractions.

This paper introduces an independent interface between operating system and application code. For implementation and testing, models written in *SystemC* are used in combination with the *Ptolemy II* [4] framework and *TinyOS* [5].

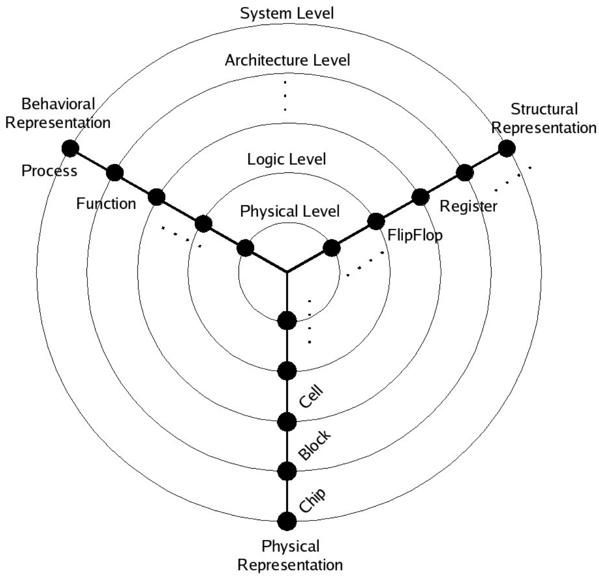

Fig.1. *The representations of digital systems with an example representation*

SYSTEM LEVEL DESIGN APPROACH

TinyOS is an open-source operating system designed for wireless embedded sensor networks. *TinyOS*`s component library includes network protocols, distributed services, sensor drivers and data acquisition tools [6].

Ptolemy II is a software framework developed as part of the Ptolemy Project. The Ptolemy project developed a multi models of computation, studies modeling, simulation, and design of concurrent, real-time, embedded systems. The focus is on assembly of concurrent components that govern the interaction between components. It supports hierarchical design, models for component interaction, includes a visual interface for model construction (Figure 2.).

System design begins as a high-level model of abstraction, provides a clear interface between behavior and structure, and presents the implementation architectures. A general Structure for the design of Wireless Systems is drawn in Figure 3.

Why should one use actually *SystemC* for models of computation *MoC*? Or, why to translate Ptolemy models to *SystemC* models would have a very beneficial effect on the industry?

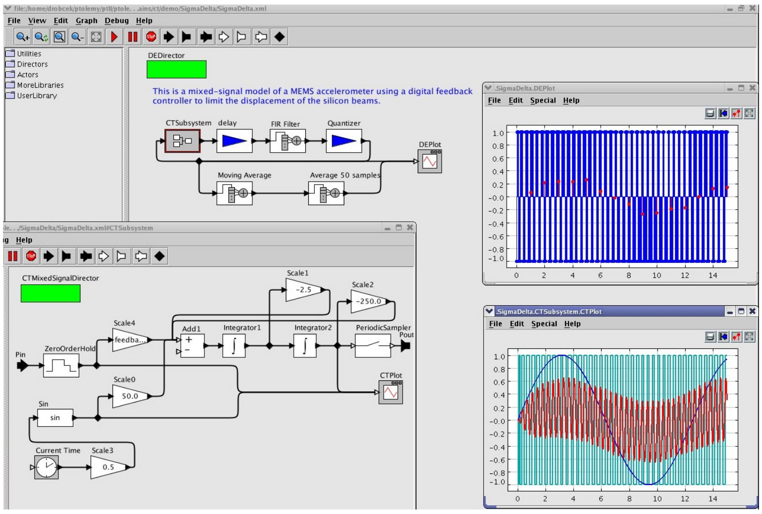

Fig.2. *Ptolemy II framework*

Most programmers are familiar with the syntax and semantics of C and many system design languages use an extended form from of C. And *SystemC* is a recent example of system design languages that extend C with additional language constructs needed for embedded systems. The so-called *SystemC* core language provides a general-purpose framework that supports a variety of models of computation, abstraction levels and design methodologies used in system design. *SystemC* is a set of C++ class libraries that can be used to created a cycle- accurate model for software algorithms, hardware architectures and interfaces, related to system- level designs [7]. It is a flexible approach because of the functionality to represent communication at various levels of abstraction. This provides the designer with new design methodologies and tools that can efficiently address all aspects of the designed systems at high levels of abstractions.

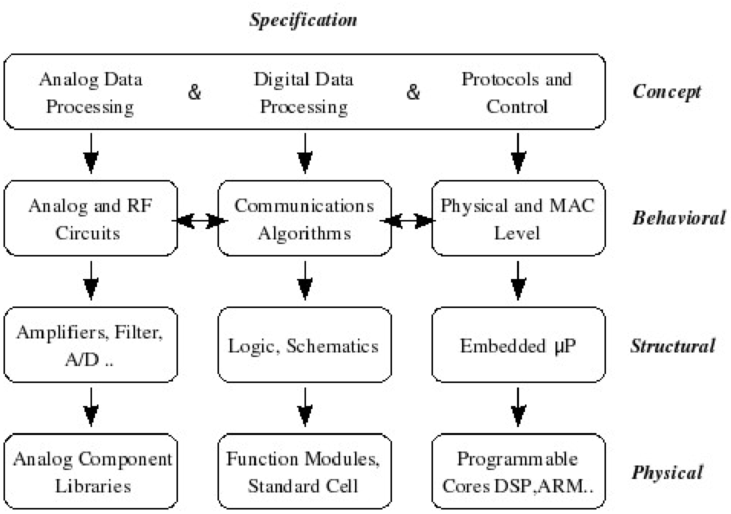

Fig.3. *Wireless System Design*

CONCLUSION

This paper illustrates the benefits of a consequent introduction and implementation of *Electronic System Level* (*ESL*) design approaches. In particular, the in use for basic models and in simulation on the *ESL* will be shown. By the common use of SystemC and *ESL* design approaches, an innovative and efficient methodology was processed thus for the draft by micro-systems with the high interest typical for analogous functional blocks. The simultaneous draft from hardware and software from system view is supported by the high abstractionslevel [8]. Also, the connectivity and communications will be described and handled on that level. These activities will contribute to the acceleration of top-level-driven design of highly integrated, modular wireless *SoC*s.

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